



## Legal Protection for Doctors in the Use of Robotic and Telerobotic Surgical Devices: Reconstruction of Distributed Causal Liability

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### Abstract

The development of health technology based on robotics, artificial intelligence, and digital telecommunication systems has encouraged the use of robotic and telerobotic surgical devices in medical procedures. These technologies improve surgical precision, expand access to specialist services, and strengthen the digital transformation of health care. However, their use also raises new legal issues, particularly regarding the limits of physician liability when patient harm results from system failure, network disruption, software error, or robotic device malfunction. This article analyzes the current legal framework for robotic and telerobotic surgical devices in Indonesia and formulates a legal protection model for physicians. This study applies normative legal research using statutory, conceptual, and comparative approaches. The findings show that Law Number 17 of 2023 concerning Health, Government Regulation Number 28 of 2024, and Minister of Health Regulation Number 3 of 2025 have not specifically regulated robotic surgery and telerobotic surgery. As a result, the distribution of liability among physicians, hospitals, technology providers, system operators, and medical device manufacturers remains normatively unclear. This article recommends the adoption of specific regulation and the implementation of the Tiered and Distributed Causal Liability Model, so that legal responsibility can be allocated proportionally based on the source of error, degree of control, and causal contribution of each actor.

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## Introduction

Health technology transformation has changed the structure of modern medical services. The development of medical robotics, artificial intelligence, and digital telecommunication systems has encouraged the emergence of robotic surgery and telerobotic surgery in medical procedures. Robotic surgery assists doctors in performing minimally invasive procedures through three-dimensional visualization, more precise instruments, and more stable motion control. Telerobotic surgery expands this function because doctors can control a robotic system from a location different from the patient through a digital communication network.

In the context of public health, this technology has strategic value. Robotic technology can improve procedural precision, reduce technical error, and expand patient access to specialist doctors in areas without complete service capacity. The WHO Global Strategy on Digital Health 2020-2025 emphasizes that digital transformation must support health system strengthening, governance, patient safety, and the integration of human resources, organizations, financing, and technology (World Health Organization, 2021). This view aligns with Indonesia's need to develop technology-based health services that are safe, accountable, and supported by a clear legal framework.

Constitutionally, the use of health technology can be understood as part of the implementation of the right to health, legal certainty, and the development of science. Article 28H paragraph (1) of the 1945 Constitution of the Republic of Indonesia guarantees the right of every person to obtain health services. Article 28D paragraph (1) guarantees fair legal certainty. Article 31 paragraph (5) affirms the role of the state in advancing science and technology. Therefore, the state must ensure that health innovation does not operate only at the technical level, but also within a legal framework that protects patients, doctors, hospitals, and technology providers.

In practice, robotic surgery in Indonesia began to be recognized through robotic urology surgery in tertiary hospitals around 2012. This technology then developed in several disciplines, including urology, gynecology, digestive surgery, prostate surgery, and the treatment of certain tumors or cancers (RSU Bunda Jakarta, 2021; Sjamsuhidajat, 2016). This development shows that Indonesia has started to enter the phase of high-precision health services. However, the readiness of legal norms has not moved as quickly as the development of medical technology.

The main legal issue arises when robotic medical procedures cause patient harm. In conventional medical services, attribution of liability generally focuses on the doctor, mainly through professional standards, service standards, and standard operating procedures. In robotic surgery and telerobotic surgery, the causal relationship is not always simple. Patient harm may result from human error, machine error, software error, algorithmic error, network disruption, system integration failure, or product defect. This condition raises a fundamental question: should doctors remain the center of liability, or should liability be distributed to other actors who also control the risk?

Indonesian positive law already contains several general instruments. Law Number 17 of 2023 concerning Health regulates the transformation of health services, telehealth, telemedicine, medical devices, medical personnel, legal protection for medical personnel, and hospital liability (Republic of Indonesia, 2023a). Government Regulation Number 28 of 2024 serves as an implementing regulation that governs health service delivery, medical personnel, health care facilities, medical devices, health information systems, health technology, and guidance and supervision (Government of Indonesia, 2024). Minister of Health Regulation Number 3 of 2025 regulates professional discipline enforcement for medical personnel and health workers (Minister of Health of the Republic of Indonesia, 2025).

Nevertheless, these three instruments do not specifically regulate robotic surgery and telerobotic surgery.

The absence of specific regulation creates a normative gap in the allocation of liability. The Health Law provides legal protection to medical personnel as long as they act in accordance with professional standards, professional service standards, standard operating procedures, and professional ethics. However, this norm has not answered situations where the doctor has complied with standards, but patient harm originates from technological failure. Government Regulation Number 28 of 2024 also focuses more on telehealth governance, information systems, system security, and operational standards, but has not developed a liability construction that distinguishes professional fault from technological failure.

The issue becomes more complex when criminal, civil, professional discipline, and electronic evidence aspects arise simultaneously. Law Number 1 of 2023 concerning the Criminal Code places fault as the basis of criminal liability, but technology-based medical procedures can complicate proof of the relationship between a doctor's conduct and the resulting harm (Republic of Indonesia, 2023b). Law Number 1 of 2024 concerning the Second Amendment to the Electronic Information and Transactions Law is also relevant because robotic and telerobotic services operate through electronic systems, digital data, and electronic documents (Republic of Indonesia, 2024). In addition, Law Number 20 of 2025 concerning the Criminal Procedure Code strengthens modern criminal procedure, including the need to use electronic evidence in the evidentiary process (Republic of Indonesia, 2025).

Previous studies have discussed the urgency of telesurgery regulation, patient protection, digital health data security, robotic surgery ethics, and hospital liability in technology-based services. However, studies that specifically place doctors as the subject of legal protection in the use of robotic and telerobotic surgical devices remain limited. This gap is important because doctors face two demands at the same time. On the one hand, doctors must protect patients and comply with professional standards. On the other hand, doctors do not always control device design, software code, algorithms, network stability, and cybersecurity systems that determine the success of the procedure.

This article offers novelty through the formulation of the Tiered and Distributed Causal Liability Model. This model places liability in a layered and distributed manner based on the source of error, degree of control, functional position, and causal contribution of each party. Under this model, doctors remain responsible for clinical judgment, informed consent, choice of indication, performance of procedures according to standards, and medical documentation. However, hospitals, system providers, network operators, software developers, and device manufacturers may also bear liability according to their scope of control and causal contribution.

Based on the above explanation, this article answers two questions. First, how does current Indonesian law regulate the use of robotic and telerobotic surgical devices in medical procedures? Second, how should legal protection for doctors be constructed in the use of robotic and telerobotic surgical devices in medical procedures?

## Methods

This study uses normative legal research. This method places law as a set of norms, principles, doctrines, and regulatory systems that must be analyzed systematically. This study uses three approaches. First, the statutory approach examines the 1945 Constitution of the Republic of Indonesia, Law Number 17 of 2023 concerning Health, Government Regulation Number 28 of 2024, Minister of Health Regulation Number 3 of 2025, the Civil Code, Law Number 1 of 2023 concerning the Criminal Code, Law Number 1 of 2024 concerning Electronic Information and Transactions, and Law Number

20 of 2025 concerning the Criminal Procedure Code. Second, the conceptual approach examines the concepts of legal protection, legal certainty, corrective justice, criminal liability, civil liability, informed consent, product liability, vicarious liability, and responsibility gaps. Third, the comparative law approach identifies tendencies in common law, civil law, and mixed legal systems in disputes concerning robotic surgery.

Primary legal materials consist of statutory regulations. Secondary legal materials consist of books, journal articles, international organization reports, and literature on health law, technology law, and civil and criminal liability. The analysis is conducted prescriptively through systematic, conceptual, and comparative interpretation. The analysis aims to construct a legal protection model for doctors in the use of robotic and telerobotic surgical devices.

## Results and Discussions

### *Legal Regulation of Robotic and Telerobotic Surgical Devices in Indonesia*

The findings show that Indonesian positive law has not regulated robotic surgery and telerobotic surgery in detail. Law Number 17 of 2023 concerning Health has opened space for the use of information and communication technology in health services. This Law also regulates telehealth, telemedicine, the right of medical personnel to obtain legal protection, the obligation of medical personnel to act according to standards, and hospital liability for negligence by health human resources in hospitals. However, these norms remain general and have not regulated robotic surgical technology as a system that contains both medical risks and technological risks.

Article 273 paragraph (1) letter a of the Health Law provides the basis for legal protection for medical personnel as long as they carry out their duties according to professional standards, professional service standards, standard operating procedures, and professional ethics. Article 274 letter b affirms the obligation to obtain consent from the patient or the patient's family for the procedure to be performed. Article 305 paragraphs (1) and (2) place the recommendation of the Professional Discipline Council as an initial mechanism in cases that may lead to legal liability for medical personnel. Article 310 regulates dispute settlement through alternative dispute resolution outside the court before litigation. Article 193 affirms hospital liability for harm caused by the negligence of health human resources in hospitals.

These norms are important. However, they are not sufficient to answer the risks of robotic surgery. The Health Law has not clearly separated doctors' professional fault, hospital governance negligence, medical device product defects, network disruption, software errors, and algorithmic failure. As a result, legal protection for doctors still depends on general interpretation. This situation risks placing doctors as the easiest party to hold liable, even when the source of harm lies outside the doctor's professional control.

Government Regulation Number 28 of 2024 also has not provided a detailed answer. Articles 549 to 563 regulate information technology in health services, telehealth, telemedicine, system security, human resource competence, and governance. However, this regulation has not contained a construction for the attribution of liability when a robotic system malfunctions, network latency occurs, software defects arise, algorithmic errors happen, or system integration fails. It also has not regulated mandatory periodic technology audits, robotic system certification standards, the obligation to store robotic operational logs, and digital forensic mechanisms for robotic medical disputes.

Minister of Health Regulation Number 3 of 2025 regulates professional discipline enforcement. This regulation is important because it provides a professional evaluation pathway before a medical dispute develops into a criminal or civil case. However, the paradigm of professional discipline in this

regulation remains closer to conventional medical services. This regulation has not treated robotic system failure, network disruption, and algorithmic error as variables that must be separated from doctors' fault.

This condition shows a specific normative gap. This gap does not mean that Indonesia has no legal basis at all. Indonesia has a general legal basis. However, that general basis is not sufficient to regulate high-risk medical services involving complex actors and systems. In H.L.A. Hart's terms, the development of robotic technology reflects the open texture of law. Existing rules cannot always predict new situations created by social and technological development (Hart, 2012).

The following table summarizes the position of Indonesian legal regulation and the remaining normative gaps.

| Legal instrument                                                        | Relevant regulatory scope                                                                                                            | Limitations for robotic and telerobotic surgery                                                                          |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1945 Constitution of the Republic of Indonesia                          | Right to health, legal certainty, and development of science and technology                                                          | Not yet operational for allocating liability in medical technology                                                       |
| Law Number 17 of 2023 concerning Health                                 | Telehealth, telemedicine, protection of medical personnel, informed consent, Professional Discipline Council, and hospital liability | Does not distinguish professional fault, institutional fault, product defect, software error, and network error          |
| Government Regulation Number 28 of 2024                                 | Governance of telehealth, health information systems, health technology, and system security                                         | Does not regulate robotic surgery certification, algorithmic audit, robotic operational logs, and liability distribution |
| Minister of Health Regulation Number 3 of 2025                          | Professional discipline enforcement for medical personnel and health workers                                                         | Does not regulate disciplinary parameters in robotic and telerobotic medical procedures                                  |
| Law Number 1 of 2023 concerning the Criminal Code                       | Principle of fault and criminal liability                                                                                            | Does not specifically regulate medical technology failures that are outside the doctor's control                         |
| Law Number 1 of 2024 concerning Electronic Information and Transactions | Electronic systems, electronic information, and electronic documents                                                                 | Does not regulate the allocation of medical-technological liability in robotic services                                  |
| Law Number 20 of 2025 concerning the Criminal Procedure Code            | Modernization of evidence and criminal procedure                                                                                     | Requires digital medical forensic standards for robotic data and telemetry                                               |

From the perspective of legal certainty theory, this situation is problematic. Lon Fuller emphasizes that a legal system must have clarity, consistency, and congruence between norms and implementation (Fuller, 1969). If the rules cannot explain who is responsible for technological failure, doctors, hospitals,

patients, and technology providers will remain in uncertainty. This uncertainty can hinder innovation, weaken patient protection, and increase the risk of criminalization of the medical profession.

Legal certainty also requires risk classification. Robotic surgery and telerobotic surgery should be positioned as high-risk medical technologies. This classification is important because these technologies do not only concern health services. They also involve electronic system security, patient safety, data protection, network reliability, and product accountability. Without risk classification, regulation will have difficulty establishing obligations for certification, audit, maintenance, incident reporting, and post-procedure evaluation.

Comparative law shows that other countries face similar issues. In common law systems, especially the United States, robotic surgery disputes tend to be analyzed through a combination of medical malpractice and product liability. Doctors may be liable if professional negligence is proven. Manufacturers may also be liable if harm originates from design defects, manufacturing defects, or failure to provide adequate warnings (Owen, 1990; Rozbruch, 2018). This approach opens room for liability distribution because the law does not view the doctor as the sole actor.

In civil law systems, such as South Korea, a fault-based liability approach remains dominant. Kim Jae Wan shows that robot surgery disputes often continue to place the determination of medical personnel negligence at the center of analysis (Wan, 2020). This approach provides certainty in conventional medical models, but it may be inadequate in robotic surgical systems involving software, digital networks, and automation functions. In a mixed legal system such as Singapore, the debate on autonomous surgical robotic systems also shows a liability dilemma when medical procedures involve AI, software, and technology manufacturers (Jamjoom et al., 2022).

This comparison shows that Indonesia needs to develop regulation that does not simply imitate one legal system. Indonesia needs a model that fits the structure of national health law. The model must protect the patient's right to legal remedy, while also protecting doctors from liability that exceeds their professional control.

### ***Legal Protection for Doctors in the Use of Robotic and Telerobotic Surgical Devices***

Legal protection for doctors has both a constitutional basis and a statutory basis. Article 1 paragraph (3) of the 1945 Constitution of the Republic of Indonesia affirms Indonesia as a state based on law. Article 28D paragraph (1) guarantees fair legal certainty. In Philipus M. Hadjon's conception, legal protection may be preventive and repressive (Hadjon, 2019). Preventive protection operates before a dispute arises through norms, procedures, standards, and participation. Repressive protection operates after a dispute arises through fair, transparent, and proportional settlement mechanisms.

In the context of robotic surgery, preventive protection must be realized through specific regulation, competence standards, credentialing and re-credentialing of operator doctors, robotic system certification, hospital standard operating procedures, software audits, cybersecurity audits, network standards, and expanded informed consent. Repressive protection must be realized through evidentiary mechanisms that distinguish human error from technological failure. Doctors must have access to robotic operational logs, electronic medical records, software audit data, telemetry data, and independent technology expert opinions.

The Health Law has provided an initial basis. Article 273 paragraph (1) letter a protects medical personnel who work according to professional standards, professional service standards, standard operating procedures, and professional ethics. Article 274 regulates the obligation to obtain patient consent, maintain patient confidentiality, and create records or documents of actions taken. Article 305 requires a Professional Discipline Council recommendation as an initial mechanism in alleged

violations that may lead to criminal or civil proceedings. Article 310 encourages dispute settlement through alternative dispute resolution outside the court. These norms can serve as an initial safeguard to prevent the criminalization of doctors.

However, this normative safeguard is not enough. Robotic surgery creates risks that doctors cannot always control. Doctors do control clinical decisions, indications, instrument use, and communication with patients. However, doctors do not design software, manufacture robots, always control network stability, or have full access to fix bugs or algorithmic errors. Therefore, legal protection for doctors must distinguish the sphere of professional control from the sphere of technological control.

Ernest J. Weinrib's corrective justice is relevant to explain this point. Legal liability requires a normative and causal relationship between the actor's conduct and the victim's harm (Weinrib, 2012). If harm arises from a software defect or network disruption outside the doctor's control, imposing the entire liability on the doctor does not satisfy the principle of proportional causal connection. John Rawls also emphasizes the importance of justice as fairness. Legal burdens should not be placed unfairly on a party that does not have full control over the source of harm (Rawls, 1999).

In criminal law, fault is the primary requirement for liability. Article 36 paragraph (1) of Law Number 1 of 2023 concerning the Criminal Code affirms that a person may only be held criminally liable for an offense committed intentionally or by negligence. Under this construction, an adverse event in robotic surgery cannot be immediately classified as a doctor's criminal act. Law enforcement authorities must prove the doctor's personal fault, causal relationship, breach of professional standards, and legally relevant harm.

In civil law, doctors may be sued on the basis of breach of contract or unlawful act if they fail to fulfill therapeutic obligations or breach professional standards. However, the relationship between doctor and patient is basically an *inspanningsverbintenis*, namely an obligation to provide professional medical efforts, not an obligation to guarantee a particular result. Therefore, a result that does not meet expectations does not automatically prove the doctor's negligence. In robotic procedures, the assessment of negligence must include technological variables.

In professional discipline, the Professional Discipline Council must assess whether the doctor has complied with professional standards and standard operating procedures. This assessment must examine clinical data and technical data. If the doctor has fulfilled clinical judgment, informed consent, documentation, supervision, and device use according to standards, then technological system failure must be directed to the party that controls the system. If harm arises from poor hospital credentialing, maintenance failure, or weak cybersecurity, the hospital must bear institutional responsibility. If harm arises from design defects, manufacturing defects, or failure to warn, the manufacturer must bear responsibility under the principle of product liability.

Helen Smith and Kit Fotheringham warn that artificial intelligence in clinical decision-making challenges traditional medical negligence approaches centered on individual doctors (Smith & Fotheringham, 2020). Nicholson Price II also shows that black-box medicine can make the attribution of liability difficult because algorithmic decisions are difficult to explain transparently (Price, 2018). This situation shows that health law must move from a physician-centered liability model toward a distributed accountability model.

On that basis, legal protection for doctors must not be understood as impunity. Doctors remain responsible if patient harm results from incorrect indication, breach of professional standards, improper device use, failure to provide reasonable supervision, inadequate informed consent, or incomplete documentation. However, doctors should not be the only party burdened with liability when

harm is also caused by hospitals, technology systems, network providers, software developers, or device manufacturers.

### ***Tiered and Distributed Causal Liability Model as a Legal Protection Model***

This article formulates the Tiered and Distributed Causal Liability Model as a model of legal protection for doctors in the use of robotic and telerobotic surgical devices. This model rests on three principles. First, liability must be determined based on the source of error. Second, liability must be determined based on the degree of control. Third, liability must be determined based on the causal contribution of each actor to patient harm.

This model does not eliminate doctors' liability. It clarifies the limits of doctors' liability. Doctors are responsible for actions that fall within their professional control. Hospitals are responsible for governance, credentialing, standard operating procedures, maintenance, risk management, and infrastructure. Technology providers are responsible for software systems, system updates, cybersecurity, and reliability. Network operators are responsible for connection stability if telerobotic services depend on a particular network. Manufacturers are responsible for product defects, design defects, manufacturing defects, and failure to provide adequate instructions or warnings.

| Source of risk                                                                                           | Actor with primary control                  | Relevant form of liability                                         | Evidentiary parameters                                                                                    |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Incorrect indication, incorrect procedure, or breach of professional standards                           | Doctor or physician in charge               | Disciplinary, civil, and criminal liability if fault is proven     | Professional standards, standard operating procedures, informed consent, medical records, expert opinions |
| Failure in credentialing, standard operating procedures, device maintenance, or operating room readiness | Hospital                                    | Corporate liability and institutional responsibility               | Credentialing documents, standard operating procedures, maintenance logs, internal audit                  |
| Software bug, algorithmic error, or system update failure                                                | Developer or system provider                | Product liability, contractual liability, and technology liability | Software audit, source of error, update history, system logs                                              |
| Latency, connection disruption, or network disconnection in telerobotic surgery                          | Network operator or infrastructure provider | Contractual liability and service provider negligence              | Network logs, service level agreement, telemetry data                                                     |



|                                                         |                                     |                                       |                                                                                       |
|---------------------------------------------------------|-------------------------------------|---------------------------------------|---------------------------------------------------------------------------------------|
| Design defect, manufacturing defect, or failure to warn | Medical device manufacturer         | Product liability                     | Product safety standards, incident reports, design documents, manuals, warning labels |
| Absence of standards and weak supervision               | Regulator and supervisory authority | Regulatory governance and supervision | Availability of standards, licensing, supervision, and incident reporting             |

The model is consistent with the views of Mark A. Hall, Mary Anne Bobinski, and David Orentlicher, who locate responsibility in modern health services at several levels: individual, institutional, and regulatory (Hall, Bobinski, & Orentlicher, 2018). It is also consistent with Richard Goldberg's view on the shift of medical malpractice responsibility from an individualistic model toward an approach that considers the role of institutions (Goldberg, 2017). In tort law, Ken Oliphant explains that responsibility can be distributed among several parties based on causal contribution and capacity to control risk (Oliphant, 2019).

The application of this model requires five regulatory instruments. First, robotic surgery and telerobotic surgery must be classified as high-risk medical technologies. This classification must be followed by operational licensing, system certification, and government supervision. Second, operator doctors must undergo credentialing, re-credentialing, certified training, and periodic competence audits. Third, hospitals must prepare specific standard operating procedures, risk management policies, maintenance systems, and incident reporting mechanisms. Fourth, technology providers must undergo software audits, cybersecurity audits, and network reliability testing. Fifth, patients must receive enhanced informed consent that explains both medical risks and technological risks.

Enhanced informed consent has an important position. In Beauchamp and Faden's theory of informed consent, the validity of consent requires adequate information, patient understanding, capacity, and voluntary decision-making (Beauchamp & Faden, 2014). In robotic procedures, information should not stop at clinical risk. Doctors and hospitals need to explain technological risks, such as robotic malfunction, system response delay, network disruption, software failure, data security risk, possible conversion to manual procedures, and emergency response mechanisms.

A digital forensic liability mechanism must also be established. This mechanism regulates the obligation to store audit logs, robotic operational logs, electronic medical records, telemetric data, video recordings according to ethical standards, and system maintenance records. These data are important to prove whether an adverse event originated from the doctor's action, device failure, network disruption, algorithmic error, or hospital governance failure. Without technical data, the evidentiary process will tend to return to the old model that places the doctor at the center of alleged fault.

From Lawrence B. Solum's procedural justice perspective, a fair legal process requires balanced opportunities for the parties to access evidence, present experts, and rebut allegations (Solum, 2004). In robotic surgery disputes, doctors need access to system data to prove that harm occurred outside their professional control. Patients also need fair access to prove fault by doctors, hospitals, or technology providers. Thus, protecting doctors does not reduce patient protection. Both are strengthened through more accurate evidence.

This model can also prevent overcriminalization. Overcriminalization occurs when criminal law is applied to events that are actually medical risks or technological risks that do not satisfy the element

of personal fault. In robotic procedures, adverse events must be examined in layers. Investigators must assess whether the doctor breached professional standards. They must also assess whether the device malfunctioned, whether the network was disrupted, whether the software was defective, whether the hospital complied with standard operating procedures, and whether the manufacturer provided adequate warnings. This approach preserves the function of criminal law as an *ultimum remedium* in technology-based medical disputes.

The Tiered and Distributed Causal Liability Model can be implemented through sectoral regulatory reform. The Ministry of Health can issue a specific regulation on the implementation of robotic surgery and telerobotic surgery. That regulation should include scope, definitions, risk classification, licensing, competence standards, operator certification, credentialing, standard operating procedures, risk management, data protection, cybersecurity, technology audit obligations, liability of each party, incident reporting, digital evidentiary mechanisms, and dispute settlement. Professional organizations can develop ethical guidelines and practice standards. Hospitals can prepare internal policies before specific regulation takes effect.

Hospitals hold a key role because robotic surgery occurs within an institutional service system. Hospitals must ensure device eligibility, operator readiness, network standards, cybersecurity systems, device maintenance, supporting teams, and emergency procedures. Vicarious liability and corporate liability can be used to assess hospital responsibility when patient harm arises from organizational failure, not merely from the doctor's conduct (Giliker, 2010). Thus, hospitals are not only service locations, but also legal actors that control technological risk.

Manufacturers and technology providers must also be included in the liability construction. Ryan Calo shows that robotics challenges the lessons of cyberlaw and traditional responsibility because robots function as cyber-physical systems that combine hardware, software, sensors, and human interaction (Calo, 2015). Frank Pasquale also emphasizes the need for new laws of robotics because the relationship among humans, institutions, and automated systems cannot be read only through the old paradigm (Pasquale, 2020). In the health context, manufacturer liability must cover design safety, reliability, system updates, instructions for use, risk warnings, and the duty to respond to incident reports.

Ultimately, legal protection for doctors in the use of robotic and telerobotic surgical devices must be constructed in a balanced manner. Doctors must not be released from professional standards. Patients must not lose their right to safety and legal remedy. Hospitals, technology providers, system operators, and manufacturers must not hide behind the status of doctors as the performers of medical procedures. The law must map the source of risk accurately. That is the core of proportional legal protection.

## Conclusion

The legal regulation of robotic and telerobotic surgical devices in Indonesia has not yet been established in a detailed and comprehensive manner. Law Number 17 of 2023 concerning Health, Government Regulation Number 28 of 2024, and Minister of Health Regulation Number 3 of 2025 provide a general basis for telehealth, telemedicine, medical personnel, health information systems, professional discipline, legal protection for medical personnel, and hospital liability. However, these instruments do not specifically regulate robotic surgery and telerobotic surgery as high-risk medical technologies. The normative gap can be seen in the absence of regulation on risk classification, system certification, operator doctor credentialing, software audits, cybersecurity audits, robotic operational logs, and liability distribution when patient harm is caused by human error, machine error, software error, algorithmic error, network disruption, or product defect.

Legal protection for doctors in the use of robotic surgery and telerobotic surgery has not provided adequate legal certainty, substantive justice, and procedural justice. Existing protection has not clearly distinguished professional fault from technological failure. Therefore, Indonesia needs to develop specific regulation that applies the Tiered and Distributed Causal Liability Model. This model allocates liability proportionally based on the source of error, degree of control, functional position, and causal contribution of each party. Doctors are responsible for clinical judgment and professional standards. Hospitals are responsible for governance and risk management. Technology providers, network operators, and manufacturers are responsible for system, software, network, or product failures that fall within their control.

## Recommendations

The Ministry of Health should promptly issue specific regulation on the implementation of robotic surgery and telerobotic surgery. The regulation should include definitions, scope, classification of high-risk technology, competence standards, certification of operator doctors, credentialing and re-credentialing, standard operating procedures, data protection, cybersecurity, technology audits, robotic operational logs, incident reporting mechanisms, allocation of legal liability, and dispute settlement. This regulation is important to fill the normative gap, ensure legal certainty, protect patients, and prevent disproportionate liability from being imposed on doctors.

Professional organizations, hospitals, doctors, and technology providers need to develop operational guidelines before specific regulation takes effect. Professional organizations should prepare ethical guidelines and competence standards for robotic surgery. Hospitals should prepare internal policies, standard operating procedures, audit systems, and risk management. Doctors should strengthen the principle of prudence, technology-risk-based informed consent, medical documentation, and training in the use of robotic systems. Technology providers should ensure reliability, cybersecurity, system updates, and access to audit logs for patient safety and legal evidence.

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